Code: 9A01404

1

B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

FLUID MECHANICS AND HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 A square metal plate 1.8 m side and 1.8 mm thick weighing 60 N is to be lifted through a vertical gap of 30 mm of infinite extent. The oil in the gap has a specific gravity of 0.95 and viscosity of 3 N. s/m^2 if the metal plate is to be lifted at a constant speed of 0.12 m/s, find the force and power required.

2 (a) What are the various types of flows? Explain in brief.
(b) Write a short note on Euler's equation.

3 (a) Explain Reynolds's experiment.
(b) Discuss and differentiate hydraulic gradient and total energy lines.

4 A set of water of diameter 50 mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangentially at one end at an angle of 30^0 to the horizontal find the resultant force of the jet on the plate if the jet is deflected through an angle of 60^0. Take g = 10 m/s^2.

5 (a) What are base-load and peak load plants?
(b) Two turbo-generators each of capacity 25000 KW have been installed at a hydel power station. During a certain period the load on the hydel plant varies from 15000 KW to 40000 KW. Find the total installed capacity, the load factor, the plant factor and the utilization factor.

6 (a) What is the role of a draft tube with respect to turbine? What are the various types of draft tubes?
(b) Explain Keplan turbine in brief.

7 (a) What is meant by cavitation? When can it occur in a turbine?
(b) A Francis turbine working under a head of 5 m at a speed of 210 r.p.m. develops 75 KW when the rate of flow of water is 1.8 m^3/s. The runner diameter is 1 m. If the head on this turbine is increased to 18 m, find its new-speed, discharge and power.

8 Explain the working of a centrifugal pump with neat sketch.

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1 The velocity distribution of flow over a plate is parabolic with vertex 30 cm from the plate where the velocity is 180 cm/s. If the velocity of the fluid is 0.9 N.s/m^2 find the velocity gradient and shear stresses at distance of 0.15 cm and 30 cm from the plate.

2 Water flows through a 0.9 m diameter pipe at the end of which there is a reducer connecting to a 0.6 m diameter pipe. If the gage pressure of the entrance to the reducer is 412.02 KN/m^2 and the velocity is 2 m/s, determine the resultant thrust on the reducer assuming that the frictional loss of head in the reducer is 1.5 m.

3 Explain venturimeter in detail with a neat sketch.

4 A jet of water of diameter 8 cm strikes a curved plate at its centre with a velocity of 18 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of 165^0. Assuming the plate smooth find. Force exerted on the plate in the direction of set, power of the jet, efficiency of the jet.

5 (a) Explain tidal plants.

(b) Differentiate storage and pondage support your answer with a neat sketch.

6 How do you design a Francis turbine runner? Give step by step procedure.

7 (a) What is meant by governing of turbines?

(b) A turbine develops 7460 KW under a head of 24.7 m at 135 r.p.m. What is the specific speed? What would be its normal speed and output under a head of 19.5 m.

8 A single acting reciprocating pump has a plunger of diameter 250 mm and stroke of 350 mm. If the speed of the pump is 60 r.p.m and it delivers 16.5 lps of water against a suction head of 5 m and a delivery head of 20 m, find the theoretical discharge, coefficient of discharge, the slip, the percentage slip of the pump and the power required to drive the pump.

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(Mechanical Engineering)

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Answer any FIVE questions

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1 A circular disc of diameter D is slowly rotated in a liquid of large viscosity (μ) at a small distance (h) from a fixed surface. Derive an expression of torque (T) necessary to maintain an angular velocity (W).

2 (a) Derive the continuity equation for one dimensional flow.

(b) Explain momentum equation and give its applications.

3 A pipe 50 mm diameter is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe the change of section being sudden? Take f =0.04 for the pipes of both diameters.

4 A jet of eater from a nozzle is deflected through 60^0 from its original direction by a curved plate which it enters tangentially without shock with a velocity of 30 m/s and leaves with a mean velocity of 25 m/s. If the discharge from the nozzle is 0.9 Kg/s, find the magnitude and direction of the resultant force on the vane if the vane is stationary.

5 (a) Explain Run-off river plants.

(b) What is a mass curve? Explain with sketch.

6 Design a Pelton wheel which is required to develop 1500 KW when working under a head of 160 m at a speed of 420 r.p.m. The overall efficiency may be taken as 85% and assume other data which is required.

7 Discuss unit and specific quantities in detail.

8 What is meant by specific speed of a pump? Derive the expression for specific speed.

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B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

FLUID MECHANICS AND HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate, which moves at 4 m/s, requires a force of 120 N to maintain the speed. Determine the dynamic viscosity of oil is 0.95.

2 (a) Derive the Bernoulli's equation.
(b) Define stream line, path line and streak line.

3 A pipe 50 mm diameter is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe the change of section being sudden? Take f =0.04 for the pipes of both diameters.

4 (a) Derive the expression for force exerted on a flat vertical plate moving in the direction of jet.
(b) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5m/s, find the force on the plate, the work done and the efficiency of jet.

5 (a) Explain pumped storage plants.
(b) A run-of-river plant is installed on a river having a minimum flow of 15 m^3/s. If the plant is used as a peak load plant operating only for 6 hours a day, find the firm capacity of the plant without pondage and with pondage but allowing 10% of the water to be lost in evaporation and other losses. Head at the plant is 10 m and the plant efficiency may be assumed as 85%.

6 (a) What are the working proportions of a Pelton wheel?
(b) Give broad classification of turbines.

7 (a) Explain constant speed characteristic curves of a turbine.
(b) What is a surge tank?

8 (a) Define static and manometric head of a centrifugal pump. State the different types of head losses which may occur in a pump installation.
(b) What are the different efficiencies of a centrifugal pump?

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